

## Keystone Biology Review Guide – Ecology

- **BIO.B.4.1.1 Describe the levels of ecological organization (i.e., organism, population, community, ecosystem, biome, and biosphere).**
  1. THE BIOSPHERE
    - THE BROADEST, MOST INCLUSIVE LEVEL
    - THE **BIOSPHERE** IS THE THIN VOLUME OF EARTH AND ITS ATMOSPHERE THAT SUPPORTS LIFE
    - ALL ORGANISMS ARE FOUND IN THE BIOSPHERE
    - LIVING THINGS ARE NOT DISTRIBUTED EVENLY THROUGHOUT THE BIOSPHERE
  2. ECOSYSTEM
    - AN **ECOSYSTEM** INCLUDES ALL OF THE ORGANISMS AND THE NONLIVING ENVIRONMENT FOUND IN A PARTICULAR PLACE.
      - CONSIDER A POND ECOSYSTEM
  3. COMMUNITY
    - A **COMMUNITY** IS ALL THE INTERACTING ORGANISMS LIVING IN AN AREA.
    - ECOLOGISTS OFTEN FOCUS ON HOW SPECIES INTERACT AND HOW THESE INTERACTIONS INFLUENCE THE NATURE OF THE COMMUNITY.
  4. POPULATION
    - A **POPULATION** INCLUDES ALL THE MEMBERS OF A SPECIES THAT LIVE IN ONE PLACE AT ONE TIME.
  5. ORGANISM
    - THE SIMPLEST LEVEL OF ORGANIZATION IN ECOLOGY
- **BIO.B.4.1.2 Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.**
  - THE LIVING COMPONENTS OF THE ENVIRONMENT ARE CALLED **BIOTIC FACTORS** — THEY INCLUDE ALL OF THE LIVING THINGS THAT AFFECT THE ORGANISM
  - THE NONLIVING FACTORS, CALLED **ABIOTIC FACTORS**, ARE THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE ENVIRONMENT.
    - TEMPERATURE
    - HUMIDITY
    - PH
    - SALINITY
    - OXYGEN CONCENTRATION
    - AMOUNT OF SUNLIGHT
    - AVAILABILITY OF NITROGEN
    - PRECIPITATION
- **BIO.B.4.2.1 Describe how energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids).**
  - Most **producers** are photosynthetic and make carbohydrates by using energy from the sun.
  - **Consumers** obtain energy by eating other organisms and include herbivores, omnivores, carnivores, detritivores, and decomposers.
    - **Food Chains and Food Webs** A single pathway of energy transfer is a **food chain**.
    - A network showing all paths of energy transfer is a food web.

- **Energy Transfer**

- Ecosystems contain only a few trophic levels because there is a low rate of energy transfer between each level.
- Energy is passed from producers to consumers to decomposers.

- **BIO.B.4.2.2 Describe biotic interactions in an ecosystem (e.g., competition, predation, symbiosis).**

- IN **PREDATION**, AN INDIVIDUAL OF ONE SPECIES, CALLED THE *PREDATOR*, EATS ALL OR PART OF AN INDIVIDUAL OF ANOTHER SPECIES, CALLED THE *PREY*.
- **EXAMPLES:**
  - **CARNIVORES** — PREDATORS THAT EAT ANIMALS
  - **HERBIVORES** — PREDATORS THAT EAT PLANTS
- **PREDATOR ADAPTATIONS:**
  - NATURAL SELECTION FAVORS THE EVOLUTION OF PREDATOR ADAPTATIONS FOR FINDING, CAPTURING, AND CONSUMING PREY.
  - PREY DETECTION MECHANISMS, CAMOUFLAGE, ADAPTED MOUTHPARTS, SPEED, ARE ALL EXAMPLES OF ADAPTATIONS
  - NATURAL SELECTION ALSO FAVORS ADAPTATIONS IN PREY THAT ALLOW THE PREY TO ESCAPE, AVOID, OR OTHERWISE WARD OFF PREDATORS.
- A **SYMBIOSIS** IS A CLOSE, LONG-TERM RELATIONSHIP BETWEEN TWO ORGANISMS.
- THREE EXAMPLES ARE:
  1. **PARASITISM**
    - IS SIMILAR TO PREDATION IN THAT ONE ORGANISM, CALLED THE *HOST*, IS HARMED AND THE OTHER ORGANISM, CALLED THE *PARASITE*, BENEFITS
    - DOES NOT RESULT IN THE IMMEDIATE DEATH OF THE HOST
    - HOSTS HAVE EVOLVED DEFENSE MECHANISMS — SKIN, TEARS, SALIVA, MUCUS, CELLS OF THE IMMUNE SYSTEM
  2. **MUTUALISM**
    - IS A RELATIONSHIP IN WHICH TWO SPECIES DERIVE SOME BENEFIT FROM EACH OTHER
    - SOME ARE SO CLOSE THAT NEITHER SPECIES CAN SURVIVE WITHOUT THE OTHER
    - POLLINATION IS ONE OF THE MOST IMPORTANT MUTUALISTIC RELATIONSHIPS ON EARTH
  3. **COMMENSALISM**
    - IS AN INTERACTION IN WHICH ONE SPECIES BENEFITS AND THE OTHER SPECIES IS NOT AFFECTED
    - SPECIES THAT SCAVENGE FOR LEFTOVER FOOD ITEMS ARE OFTEN CONSIDERED COMMENSAL SPECIES

- **BIO.B.4.2.3 Describe how matter recycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle, and nitrogen cycle).**

**The Water Cycle**

- Key processes in the **water cycle** are evaporation, transpiration, and precipitation.

**The Carbon Cycle**

- Photosynthesis and cellular respiration are the two main steps in the **carbon cycle**.

**Nitrogen Cycle**

- **Nitrogen-fixing bacteria** are important in the **nitrogen cycle** because they change nitrogen gas into a usable form of nitrogen for plants.

### Phosphorus Cycle

- In the **phosphorus cycle**, phosphorus moves from phosphate deposited in rock, to the soil, to living organisms, and finally to the ocean.

### Oxygen Cycle

- A plant does Photosynthesis to let off Oxygen for organisms to use.
- The humans use up the Oxygen through Respiration and let off Carbon Dioxide.
- The Carbon Dioxide is then passed from the humans to the green plants once again.
- **BIO.B.4.2.4 Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires).**

- ONE OF THE MOST IMPORTANT CHARACTERISTICS OF A COMMUNITY IS HOW IT RESPONDS TO DISTURBANCE. **DISTURBANCES** ARE EVENTS THAT CHANGE COMMUNITIES, REMOVE OR DESTROY ORGANISMS FROM COMMUNITIES, OR ALTER RESOURCE AVAILABILITY.
  - ABIOTIC DISTURBANCES — DROUGHTS, FIRES, FLOODS, VOLCANIC ERUPTIONS, EARTHQUAKES, STORMS
  - BIOTIC DISTURBANCES — ELEPHANTS TEARING UP TREES WHILE EATING, BULLDOZING, CLEAR-CUTTING, PAVING, PLOWING, AND MOWING LAND.
  - SOME ORGANISMS MAY DEPEND ON DISTURBANCES TO SURVIVE
  - MAY CREATE THE OPPORTUNITIES FOR NEW SPECIES TO OCCUPY A NEW HABITAT
- THE GRADUAL, SEQUENTIAL REGROWTH OF A COMMUNITY OF SPECIES IN AN AREA IS CALLED **ECOLOGICAL SUCCESSION**
- TWO TYPES OF SUCCESSION:
  1. **PRIMARY SUCCESSION** IS THE DEVELOPMENT OF A COMMUNITY IN AN AREA THAT HAS NOT SUPPORTED LIFE PREVIOUSLY, SUCH AS BARE ROCK, A SAND DUNE, OR AN ISLAND FORMED BY VOLCANIC ERUPTION.
  2. **SECONDARY SUCCESSION** IS THE SEQUENTIAL REPLACEMENT OF SPECIES THAT FOLLOWS DISRUPTION OF AN EXISTING COMMUNITY; OCCURS WHERE SOIL IS ALREADY PRESENT.
- THE COMMUNITY PROCEEDS THROUGH A PREDICTABLE SERIES OF STAGES UNTIL IT REACHES A STABLE END POINT, CALLED THE **CLIMAX COMMUNITY**.
  - EACH STAGE PAVES THE WAY FOR THE NEXT LEADING TO THE CLIMAX COMMUNITY WHICH REMAINS CONSTANT FOR A LONG PERIOD OF TIME.

- **BIO.B.4.2.5 Describe the effects of limiting factors on population dynamics and potential species extinction.**
  - When the **carrying capacity** is reached, the number of individuals the environment can support is reached and population growth becomes stable.
  - Any factor that restrains the growth of a population is a **limiting factor**. (Space, sunlight, food, water, availability of mates)
  - As the population grows, competition for resources increases. Thus reproduction shrinks over time. This may lead to species extinction.